

# REVISION OF THE GENUS *STERIGMAPETALUM* (RHIZOPHORACEAE)

JULIAN A. STEYERMARK<sup>1</sup> AND RONALD LIESNER<sup>2</sup>

## ABSTRACT

The genus *Sterigmapetalum* consists of 7 species, with 4 newly described species (*S. exappendiculatum*, *S. heterodoxum*, *S. resinosum*, and *S. tachirense*), and 1 new subspecies (*S. guianense* subsp. *ichunense*). On the basis of the presence or absence of a resinous exudate, development or reduction of lateral flanges of the petals, and opposite or verticillate leaves, two subgenera are recognized: *Sterigmapetalum* and *Balsamocaulon*. On the basis of their hypogynous flowers and superior ovaries, *Cassipourea* and *Sterigmapetalum* are placed in a new tribe, Hypogyneae, within the Rhizophoraceae. A key to the species is provided, followed by a description of the species and their geographical distribution. Newly discovered anatomical evidence, which reveals the presence of a P-type sieve element in the Rhizophoraceae, indicates that the family should be excluded from the Myrtales and is additional evidence supporting the view provided by the gross morphological floral details that the family is atypical in the Myrtales, and should be removed from that order.

*Sterigmapetalum* was established in 1925 by Kuhlmann with a single species, *S. obovatum*, collected from Amazonian Brazil. It was differentiated from what was considered a related genus, *Blepharistemma* Wall. ex Benth., by the possession of dioecious flowers, of calyx segments and stamens, absence of a disc, and a greater number of cells of the ovary. Since that time, two additional species, *S. colombianum* Monachino (1944) from Colombia, and *S. guianense* Steyermark (1952) from the Venezuelan Guayana, have been published.

During recent explorations in Venezuela near the Colombian border, a fourth species has been discovered. In an attempt to bring our present knowledge of the genus up-to-date, material has been borrowed from the herbaria of F, NY, and US. Unfortunately, the dioecious character of the genus, together with the paucity of specimens available in herbaria, have added to the difficulties of revision. However, as a result of this study, additional taxa have become manifest and are described below. We wish to thank the curators of the aforementioned herbaria for the loan of their material.

## GROSS MORPHOLOGY

A resinous exudate covers the young buds, peduncles, and upper internodes of the stem in *S. heterodoxum* and *S. exappendiculatum*, but is not found among other members of the genus. This character, associated with the reduced lat-

eral flanges of the petals, and opposite leaves, form the basis for the establishment of a subgeneric category within the genus.

*Stipules.* The stipules are uniformly interpetiolar throughout the taxa. They are glabrous in *S. colombianum*, *S. tachirense*, *S. heterodoxum*, and *S. exappendiculatum*. In *S. obovatum* and *S. guianense* a more or less persistent, densely sericeous indument covers the external surface.

*Leaves.* The leaves are usually 3–4-verticillate, but in *S. heterodoxum* and *S. exappendiculatum* of subgenus *Balsamocaulon* they are always opposite. Occasional terminal leaves of *S. tachirense*, a taxon with ordinarily 3-verticillate leaves, may be opposite. The leaf blades are mainly cuneate at the base and broadest above the middle, resulting usually in an obovate shape. In *S. tachirense* they are rounded or broadened at the base. In *S. exappendiculatum* they are elliptic-oblong and broadest toward the middle. The leaf margins are mainly entire, but show varying degrees of crenulation, rather markedly so in *S. exappendiculatum*.

*Inflorescence.* The inflorescence is usually subterminal and arises in the axils of the uppermost leaves. Two or more peduncles near the apex of the stem in the axils of the uppermost leaves are present in several species, but in *S. heterodoxum* and *S. exappendiculatum* of subgenus *Balsamocaulon* the peduncles arise lower on the stem between the second and sixth internodes below the apex, and are solitary in the leaf axils. The

<sup>1</sup> Herbario Nacional de Venezuela, Caracas, Venezuela.

<sup>2</sup> Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166.

flowers are arranged in unbranched or 1–4-branched dichotomous cymes, and are sessile to shortly pedicellate. In subgenus *Balsamocaulon* the peduncles are covered with a resinous exudate, especially near the apex.

*Calyx.* The calyx is valvately 4–7-toothed. *Sterigmapetalum tachirensis* is the only species thus far known in the genus with four calyx lobes. The calyx tube encloses the floral parts, but is hypogynous and not coherent either with the ovary or other parts of the flower. The outer surface varies from glabrous to densely sericeous. In subgenus *Balsamocaulon* a resinous exudate covers the young calyx and margins of the lobes, which are manifestly elevated into thickened, linear ridges. The inner surface of the calyx lobes is usually densely strigose or sericeous.

*Petals.* The petals are free and hypogynous, inserted at the base of the flower between the base of the calyx tube and the disclike membrane to which the stamens are attached (Fig. 1A). They vary in number from four to six and differ greatly in ornamentation (Fig. 2). In shape they vary from linear, oblanceolate, to panduriform, with a usually 3-lobed or 3-parted apex and two lateral flanges or lobes bearing 2–18 short to elongated, fimbriate, often curling appendages (Fig. 1A). Between the lateral flanges is a central, hooded, incurved portion with three to many crowded, involute appendages. This central apical part is often surmounted by a penicillate tuft of hairs, which are also inflexed. Hairs may also be present on the dorsal part of the petal, and occasionally elsewhere. Sometimes, as in *S. exappendiculatum*, the apical tuft of hairs, as well as the fimbriate lateral flanges, are lacking (Fig. 2: 2A, 2B).

*Androecium.* The stamens vary in number from 8 to 12 in the staminate flowers, and are usually unequal in an alternating arrangement (Fig. 1C). The anthers are versatile, dorsifixed, broadly oblong, and rounded at both ends. The filaments are attached to the border of an annular membranous structure, which has been referred to as a disc (Fig. 1C). This structure could be equally interpreted as the fused bases of the filaments. It is inserted at the base of the flowers between the base of the petals and the ovary or ovary rudiment.

*Gynoecium.* The ovary is completely superior in the pistillate flower (Fig. 1A), as is the ovary rudiment in the staminate flower (Fig. 1B). Both are inserted on the receptacle at the base of the flower. The ovary is depressed-globose to sub-

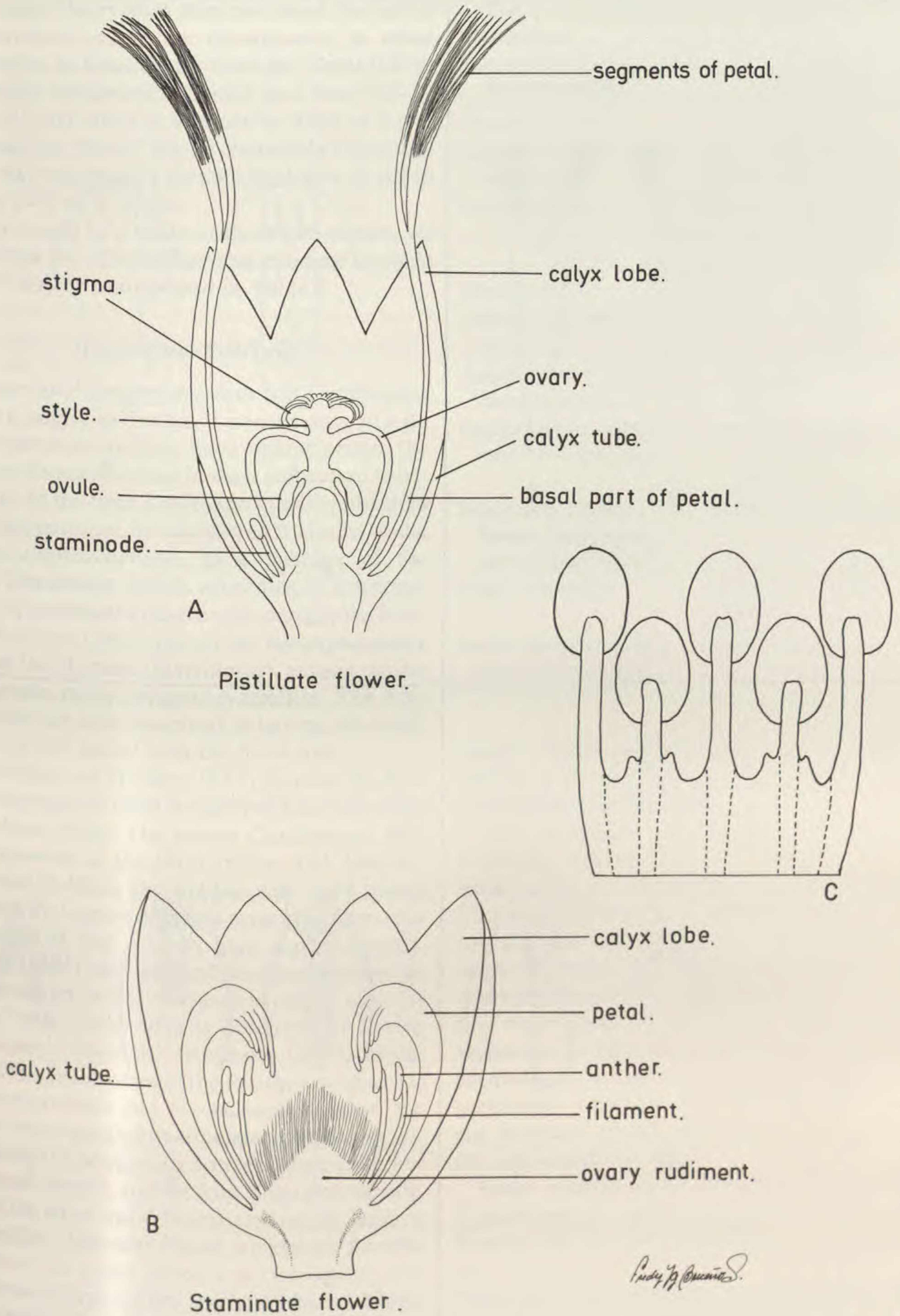
obovate, and 5–6-locular with two pendulous ovules in each cell. In the few species in which pistillate flowers are known, it is covered by a dense tomentum. The style is very short or obsolete. The very short styler branches are covered by a crowded mass of incurved stigmatic threads, which form a radiate structure depressed centrally. At the base of the ovary but not adherent to it is the disc. In the pistillate flowers, minute projecting staminodia, usually 10–12 in number, are attached to the border of the disc (Fig. 1B).

*Anatomical features.* As a result of his recent studies of sieve-element plastids in various families usually included within the Myrtales, Behnke (1983) found the so-called (S-type) plastid, those containing several spherical starch grains, to be characteristic and constant within the order. Of great significance is his discovery that the sieve-element plastids of the Rhizophoraceae are completely unlike those of any of the other families of the Myrtales in lacking starch, but instead contain numerous protein crystals, for which reason these plastids are placed in the P-type group. Although the genera *Sterigmapetalum* and *Cassipourea* were not studied by him, four other genera (*Rhizophora*, *Bruguiera*, *Carallia*, and *Crossostylis*) were investigated.

#### GENERIC AFFINITIES

The genus *Sterigmapetalum* is closely related to *Cassipourea* Aubl. Both genera have superior ovaries, in which respect they are at variance with the other genera placed within the family Rhizophoraceae. In a revision of the Amazonian species of the family, Prance et al. (1975) differentiated these two genera on the basis of verticillate (*Sterigmapetalum*) vs. opposite (*Cassipourea*) leaves, lacinate petals (*Sterigmapetalum*) vs. spatulate petals with appendages (*Cassipourea*), and pedunculate inflorescences (*Sterigmapetalum*) as opposed to sessile, axillary ones (*Cassipourea*). In light of our present knowledge, it should be modified to state that the petals of *Sterigmapetalum* usually have two lateral flanges, each with 2–18, short to elongated, fimbriate appendages, borne on either side of an incurved or inflexed, central lobe furnished either with a dense tuft of hairs or with three appendages.

When Kuhlmann described *Sterigmapetalum* (1925), he stated that the genus, as then known, only from Brazil, comprised very tall trees inhabiting high land, whereas *Cassipourea* was considered to be a genus of small trees. However,



*P. Steyermark*

FIGURE 1. A. *Sterigmapetalum obovatum*, pistillate flower, semi-diagrammatic. B. *Sterigmapetalum guianense*, staminate flower, semi-diagrammatic. C. Portion of androecium with annular disk, showing alternating longer and shorter filaments, *Sterigmapetalum guianense*.

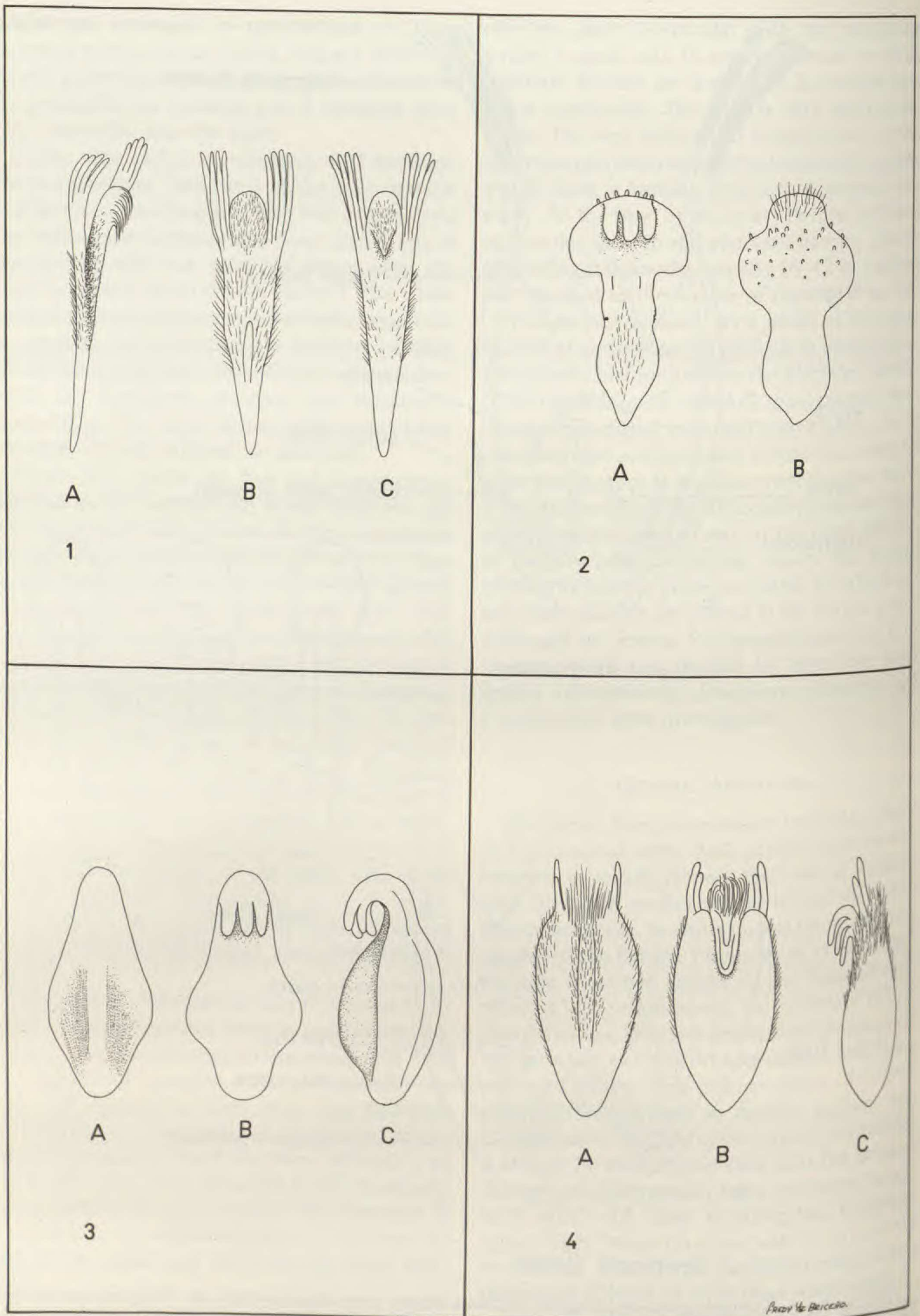


FIGURE 2. *Sterigma-petalum guianense* subsp. *ichunense*, 1A. Petal, lateral view; 1B. Petal, dorsal view; 1C. Petal, ventral view. *Sterigma-petalum exappendiculatum*, 2A. Petal, ventral view; 2B. Petal, dorsal view. *Sterigma-petalum resinosum*, 3A. Petal, dorsal view; 3B. Petal, ventral view; 3C. Petal, lateral view. *Sterigma-petalum heterodoxum*, 4A. Petal, dorsal view; 4B. Petal, ventral view; 4C. Petal, lateral view.

this latter observation does not stand the test of observations made on *Cassipourea* in other countries. In Panama, for example, Croat (1978) reported *Cassipourea elliptica* as a tree "13–17 m tall," and refers to a report by Allen to a tree as much as "30 m" tall. In Venezuela *Cassipourea* may vary from a shrub only 1.8–4 m tall to trees 8–15 m in height.

As a result of a study of these two genera, we find that the chief differences existing between them may be summarized in Table 1.

#### TAXONOMIC POSITION

Since both *Sterigmapetalum* and *Cassipourea* have hypogynous flowers, it is instructive to note how previous workers have characterized the family Rhizophoraceae in their respective treatments. At the time Kuhlmann (1925) published *Sterigmapetalum*, he considered it closest to the genus *Blepharistemma*, as a member of the tribe **Macariseae**, which, according to Schimper (1893), consisted of genera with perigynous flowers. Melchior (1964) placed the Rhizophoraceae within the Myrtales (Myrtiflorae), among mostly epigynous, rarely perigynous families. The Rhizophoraceae were described as having the ovary more or less united with the floral axis.

Bentham and Hooker (1862) divided the Rhizophoraceae (by them designated Rhizophoreae) into three tribes. The genera *Cassipourea*, *Blepharistemma* of the West Indies, and *Dactylopetalum* of Africa and Madagascar, were placed in the tribe Legnotideae and separated from other genera of that tribe by their superior ovary. Engler (1876) characterized the Rhizophoraceae as having an ovary "*saepissime infero, raro supero*," and *Cassipourea* is described as having the ovary "*liberum*." Schimper (1893) recognized two subfamilies of the Rhizophoraceae: (1) **Rhizophoroideae** and (2) **Anisophylloideae**, the former distinguished by stipulate, opposite leaves, epigynous or perigynous flowers, single style, endosperm present, and the fruit a berry or capsule, while the latter was differentiated on the basis of exstipulate, alternate leaves, epigynous flowers, three or four styles, absence of endosperm, and the fruit a drupe, or dry and indehiscent. Moreover, within the subfamily **Rhizophoroideae** two tribes were elaborated: (1) **Gynotrocheae** with epigynous flowers, seed without appendages, leaf blades with calcium oxalate crystals, and placenta continuous with the style, and (2) **Macariseae** with perigynous flowers, seed with appendages,

TABLE 1. Comparison of *Sterigmapetalum* and *Cassipourea*.

| <i>Sterigmapetalum</i>   | <i>Cassipourea</i>                                    |
|--|---|
| Flowers dioecious.   | Flowers perfect.                                      |
| Style absent with sessile large stigma.                            | Style elongated and exerted.                          |
| Stamens included.  | Stamens at least equaling calyx and slightly exerted. |
| Stamens 8–12.  | Stamens 20–25.  |
| Inflorescence pedunculate.   | Inflorescence sessile.                                |
| Appendages of lateral flanges glabrous.                            | Appendages of petals pilosulous.                      |
| Lateral flanges of petals with 2–18 appendages.                    | Lateral flanges of petals with numerous appendages.   |
| Petals with 2 lateral flanges (lobes) and a central incurved lobe. | Petals simple, not lobed.                             |
| Ovary 5–6-celled.  | Ovary 2–4-(usually 3)-celled.                         |
| Leaves 3–4-verticillate, more rarely opposite.                     | Leaves opposite.                                      |

simple crystals together with pairs of calcium oxalate in the leaf blades, and the placenta discontinuous with the style.

This treatment was modified by Melchior (1964) by treating the above categories as four equal tribes: (1) **Macariseae**, (2) **Gynotrocheae**, (3) **Anisophylleae**, and (4) **Rhizophoreae**, the first two characterized by the possession of stipulate opposite leaves, one style, and endosperm, the **Anisophylleae** by its exstipulate leaves, three to five styles, and no endosperm, and the **Rhizophoreae** by being mangrove plants with seeds producing an elongated protruding hypocotyl that germinates within the fruit; the other tribes consist of inland plants whose seeds germinate in the soil outside the fruit.

Many authors have characterized the Rhizophoraceae as having perigynous or epigynous flowers with the ovary stated to be mostly inferior. Lawrence (1963) described the stamens as "situated on the outer edge of a lobed perigynous or epigynous disk," but further characterized the family as having the "ovary variable in position depending on degree of adnation of perianth (i.e., superior, half inferior, or incompletely inferior)," while Standley and Williams (1962) described the ovary as "usually inferior," but also stated

that the "calyx-tube is more or less adnate to the ovary, rarely free, the limb produced beyond the ovary," but, in their description of the genus *Cassipourea* indicated the ovary as free. Heywood (1978) stated that the flowers are "hypogynous to epigynous," and the ovary "inferior or superior." Aristeguieta (1973) described the ovary as varying from superior to semi-inferior, and correctly characterized *Sterigmapetalum* and *Cassipourea* as genera having superior ovaries. Croat (1978), likewise, correctly stated that the ovary is superior in *Cassipourea*, as did Jonker (1942). In his description of the family Rhizophoraceae Hutchinson (1959) stated that the calyx tube is "adnate to the ovary or free."

Cronquist (1968) placed the Rhizophoraceae in the order Cornales, characterized by him partly as having epigynous flowers and indehiscent fleshy fruits. He also considered that its possession of well-developed endosperm and unitegmic ovules was consistent with its inclusion as a family within the Cornales. At that time he believed it to be "most useful to include the Rhizophoraceae in the Cornales as a near-basal side-branch not far distant from the Myrtales. If one prefers small orders and does not object to monotypes, the establishment of a separate order might perhaps be defended."

This concept of a distinct order for the Rhizophoraceae was subsequently defended by Cronquist (1981: 655-659). In this latest work (Cronquist, 1981), he recognized the family as a monotypic, separate order, Rhizophorales, which he placed between the Myrtales and Cornales. Principally on the basis of its absence of internal phloem, he separated the Rhizophorales from the Myrtales, while from the Cornales the separation is based mainly on the possession of bitegmic instead of unitegmic ovules, although he previously (Cronquist, 1968) stated that unitegmic ovules were common to both Rhizophoraceae and Cornales, as well as by additional characters of stipulate leaves and absence of iridoid compounds.

The flowers of the Rhizophoraceae are stated by Cronquist (1981) to be perigynous or epigynous, but he mentioned the genera *Cassipourea* and *Macarisia* as having perigynous flowers with a superior ovary. Actually, Cronquist (1981) expressed uncertainty in the proper disposition of the Rhizophoraceae, and suggested various possibilities for its placement, not only in the Cornales and Myrtales, both of which he believed

unjustified, but also in the order Rosales. The latter order he considered as having characters too primitive to encompass the Rhizophoraceae, although he suggested that affinities with the Grossulariaceae and Hydrangeaceae might be conceivable. Since the Rhizophoraceae are not compatible with any of these three orders, Cronquist's alternative was to treat the family as a distinct, monotypic order.

Recent anatomical investigations on the plastids of sieve elements support the view that the Rhizophoraceae should be excluded from the Myrtales. The previous work on nearly 400 families of flowering plants by different workers (Behnke, 1974, 1976, 1981a, 1981b, 1982a, 1982b; Behnke & Pop, 1981; Dahlgren, 1980; Dahlgren & Thorne, 1983; Mabry, 1977) have shown that the plastids of the sieve element may be referred to either the S-type with starch grains or the P-type with protein crystals. Based on P-type plastids in the Rhizophoraceae, as contrasted with S-type in other families of the Myrtales (Melastomataceae, Crypteroniaceae, Penaceae, Oliniaceae, Combretaceae, Lythraceae, Sonneratiaceae, Punicaceae, Myrtaceae, Trapaceae, and Onagraceae), Behnke (1982b) suggested that the Rhizophoraceae be excluded from the Myrtales.

These new anatomical data provide further evidence to support the previously noted trend in the family from hypogyny to epigyny, and especially the atypical condition of *Sterigmapetalum* and *Cassipourea*, as being inconsistent with other members of the Rhizophoraceae and families of the Myrtales. The combination of anatomical evidence with that of the divergent floral structures of the Rhizophoraceae may well justify the exclusion of the family from the Myrtales, and claim for it a new position within an alliance of families having P-type plastids and compatible floral features.

#### TAXONOMY

Since both *Sterigmapetalum* and *Cassipourea* have hypogynous flowers with completely superior ovaries that are not united to the floral axis (Fig. 1A, B), they may be considered here as constituting a new tribe within the family, described as follows:

TRIBE HYPOGYNEAE Steyermark & Liesner.  
Type: *Cassipourea* Aubl., Fl. Guiane 1: 529.  
t. 211. 1775.

Flores hypogyni. Folia opposita vel verticillata. Ovarium superum.

**Sterigmapetalum** Kuhlmann, Arch. Jard. Bot. Rio de Janeiro 4: 359. t. 32. 1925. TYPE: *Sterigmapetalum obovatum* Kuhlmann; Aristeguieta, Fam. Gen. Arb. Ven. 605. 1973; Albuquerque in Prance et al., Acta Amaz. 5: 13. 1975.

Trees with interpetiolar stipules. Leaves opposite or 3–4-verticillate, petiolate, entire or crenulate-serrulate. Inflorescence axillary, subterminal or in the upper axils, pedunculate, cymose, the cymes congested, unbranched or dichotomously 1–4-branched. Flowers unisexual (the plants dioecious), actinomorphic, few to numerous, sessile or pedicellate. Calyx campanulate, 4–7-dentate or -lobed, the teeth or lobes valvate. Petals usually of the same number as the calyx lobes, 4–6, free, hypogynous, inserted between the base of the calyx tube and the base of the staminal membrane, linear, oblanceolate or panduriform, 3-lobed or 3-parted at the apex with 2 lateral flanges bearing 2–18, short to elongated, fimbriate appendages on either side of a central, hooded, inflexed portion bearing 3 to many crowded, incurved appendages, this central portion often surmounted by an inflexed penicillate pubescent tuft. Stamens 8–12, usually unequal. Anthers versatile, dorsifixed, broadly

oblong, rounded at the base and apex. Filaments attached to the border of or fused with a basal annular membrane which is hypogynously inserted at the base of the flower. Ovary rudiment present in the staminate flowers. Ovary superior, depressed-globose to subobovate, 5–6-locular, each cell 2-ovulate; ovules pendulous. Style very short or obsolete, the very short stylar branches covered by a crowded mass of incurved stigmatic threads. Fruit a septicidal, 5–6-celled capsule; seeds collateral, pendulous, oblong, winged; wings oblong-falciform, appendiculate or elongated, caducous. Endosperm oleaginous, slightly thick; radicle cylindrical; cotyledons foliaceous, flat, about equaling the length of the radicle.

Geographical distribution: Seven species are known, distributed in Amazonian Brazil north to the Guianas, Venezuela, and eastern Colombia (Fig. 3).

The genus *Sterigmapetalum* may be divided into two subgenera:

- 1a. No resinous exudate present; leaves usually 3–4-verticillate, rarely opposite; lateral flanges of the petals well developed with several to many fimbriate appendages ..... Subgenus *Sterigmapetalum*
- 1b. Resinous exudate present on young buds, peduncles, and upper cauline axis; leaves opposite; lateral flanges of the petals reduced to nearly obsolete ..... Subgenus *Balsamocaulon*

#### KEY TO THE SUBGENERA AND SPECIES OF *STERIGMAPETALUM*

- 1a. Leaves always opposite; resinous exudate present on apical portion of stem, peduncle, and buds; peduncle solitary, axillary between the 2nd and 6th nodes below the apex of the stem ..... Subgenus *Balsamocaulon*
- 2a. Leaves acute or subacute and narrowed at the apex, broadest at the middle; stipules acute to acuminate; petals lacking lateral flanges, glabrous ..... 6. *S. resinosum*
- 2b. Leaves truncate to rounded at the summit, broadest above the middle; stipules obtuse; petals with 2 lateral flanges, ciliate, apically densely pilose ..... 7. *S. heterodoxum*
- 1b. Leaves mainly 3–4-verticillate, rarely opposite; resinous exudate absent; peduncles at or just below apex of stem ..... Subgenus *Sterigmapetalum*
- 3a. Leaves rounded at the base; staminate flowers 4-merous ..... 5. *S. tachirense*
- 3b. Leaves mainly cuneate, acute or subobtuse at the base; staminate or pistillate flowers 5–6-merous, rarely 7-merous.
- 4a. Peduncles 3–7 cm long; inflorescence manifestly 2–4-dichotomously branched; lateral flanges of the petals 14–21 mm long including the appendages greatly exceeding the calyx tube, 14–21 mm long ..... 1. *S. obovatum*
- 4b. Peduncles 0.3–3 cm long; inflorescence either 1-dichotomous or with fasciculately crowded flowers terminating the axes; lateral flanges of the petals, including the appendages, at most 6 mm long, scarcely equaling or only slightly exceeding the calyx tube.
- 5a. Leaves broadest at the middle, narrowed above the middle to the apex; leaf margins more or less denticulate-crenulate; petals lacking fimbriate lateral flanges ..... 3. *S. exappendiculatum*
- 5b. Leaves broadest above the middle, truncate-rounded or emarginate at the apex; leaf margins entire; petals with fimbriate lateral flanges.
- 6a. Upper leaf surface with conspicuously elevated tertiary venation.

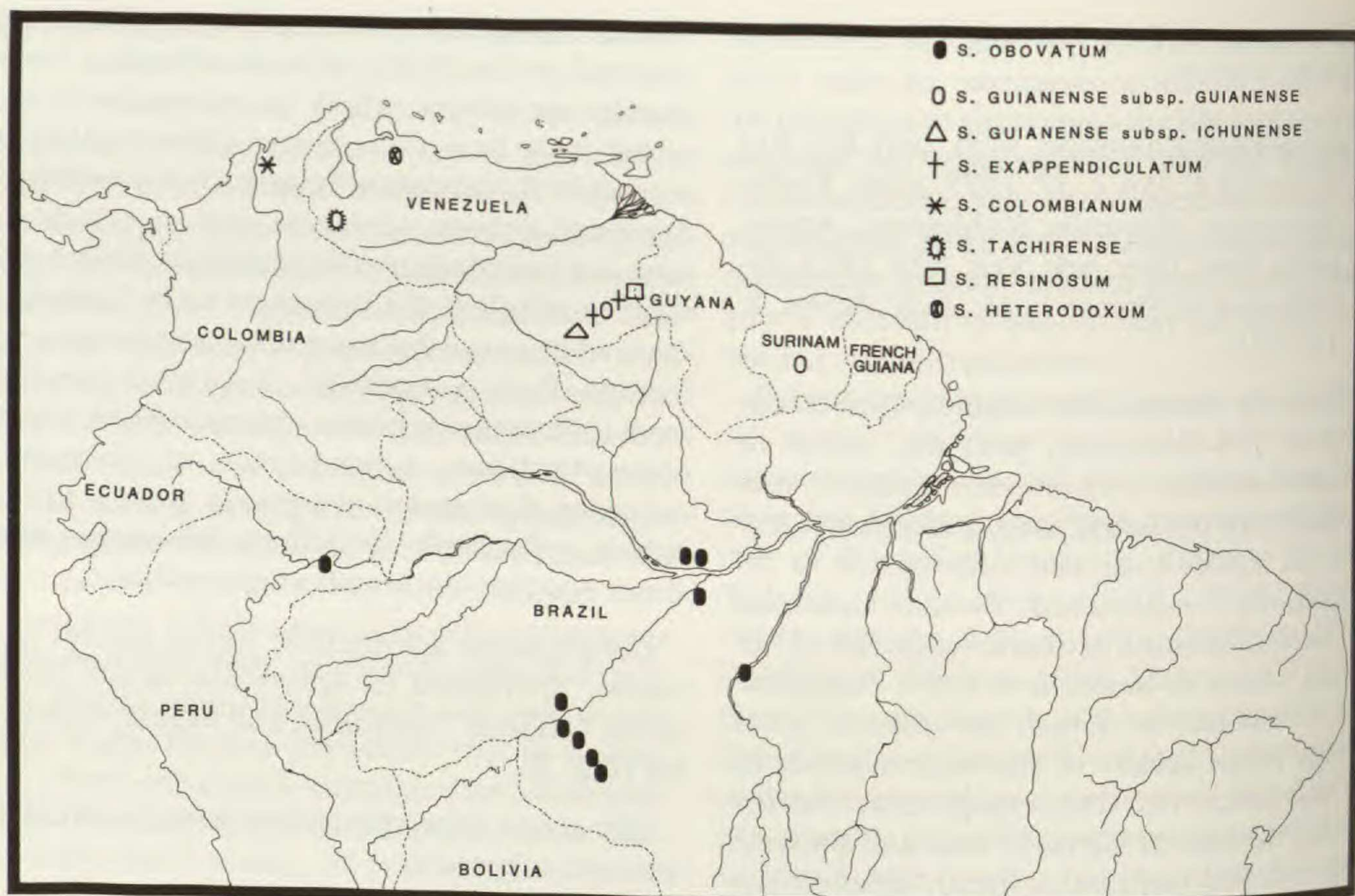


FIGURE 3. Geographical distribution of the genus *Sterigmapetalum*.

- 7a. Stipules glabrous without; calyx exterior glabrous or at most sparsely appressed-pubescent ..... 4. *S. colombianum*  
 7b. Stipules densely pubescent without; calyx exterior densely sericeous .....  
 ..... 2a. *S. guianense* subsp. *guianense*  
 6b. Upper leaf surface lacking elevated tertiary venation .....  
 ..... 2b. *S. guianense* subsp. *ichunense*

### *Sterigmapetalum* subgenus *Sterigmapetalum*.

TYPE: *Sterigmapetalum obovatum* Kuhlmann.

Exsudatum resinosum nullum. Folia vulgo 3-4-verticillata, raro opposita. Extensiones laterales petalorum bene evolutae cum appendicibus fimbriatis.

1. *Sterigmapetalum obovatum* Kuhlmann, Arch. Jard. Bot. Rio de Janeiro 4: 360. t. 32. 1925. TYPE: Brasil, Amazonas, Porto Velho, rio Madeira, 7 Sept. 1923, Kuhlmann 17933 (RB, holotype; US, isotype); Albuquerque in Prance et al., Acta Amaz. 5:15. 1975.— Fig. 1A, Fig. 3.

Trees 10-30 m tall; branches 3-5-verticillate, quadrangulate; upper internodes densely buff-tomentellose, the lower internodes glabrescent. Leaves 3-5-verticillate, petiolate, the petioles 5-15(-20) mm long, densely buff tomentellose; leaf blades coriaceous, obovate, rounded to sub-emarginate at the apex, obtuse to acute at the

base, 7-17 cm long, 3.5-11 cm wide, glabrous and prominently nerved above, tomentose below on the nerves, less densely pubescent on the surfaces, entire, slightly revolute, the lateral nerves 11-19 on each side, ascending, straight, anastomosing near the margins, subsulcate above, elevated below, the tertiary veinlets reticulately prominent on both sides. Inflorescence solitary in the upper axils, but several present among the crowded leaves; peduncles 3-6 cm long, densely buff-tomentose. *Staminate inflorescence*: Dichotomously 3-forked. Flowers sessile, few on each axis. Calyx deeply campanulate, 5-6 mm long, 3-4 mm wide, densely buff-appressed tomentellose without. Petals 15 mm long, the laminate portion linear-oblongate to ligulate-oblongate, 5 mm long, 1 mm wide, glabrous, apically 3-lobed, the apical central portion 0.5-0.8 mm long, bordered by 2 lateral flanges 9-10 mm long, each lateral flange bearing 4-5 filamentous appendages basally attached to a lam-



inar portion 2 mm long; apical margin of the central portion bearing 3 short appendages 0.5–0.8 mm long on one side and 1 elongated appendage 9–10 mm long on other side. Stamens 10 in one equal series; filaments free in the upper 0.5 mm, united into a membrane at the base 1.5 mm long; anthers narrowly oblong, subemarginate, 1.2 mm long. Ovary rudiment conic, 1.7 mm long, 0.8 mm wide, densely buff tomentose or sericeous. *Pistillate inflorescence*: forked cyme with 2–3 flowers borne on each axis. Flowers subpedicellate; pedicels 0.5–1.5 mm long, densely buff-tomentellose. Calyx deeply campanulate, narrowed basally, 7–8 mm long, 4–5 mm wide above the base, 1.5 mm wide at the base; calyx lobes 5–7, triangular, acute, 1.5–2.7 mm long, 1.5–1.7 mm wide, sericeous within. Petals 5, 20–21 mm long, the laminar portion ligulate, 5 mm long, 1.5 mm wide, the fimbriate apical portion 15–16 mm long with 3 short middle appendages 1 mm long, and 2 lateral flanges bearing 4–5 elongate appendages, the united portion at the base 2.5–3 mm long, 0.7–1 mm wide. Ovary 5-celled, depressed-subglobose, subtruncate at the base, obtusely 5-angled, 2 mm long, 3 mm wide, densely tomentose. Staminodes 10, 0.8 mm long, the aborted anthers globose, 0.1 mm long and broad, the filamentous portion 0.6–0.7 mm long, united more than half-way down, the united portion 0.4 mm long at the base. Fruit obovate or oblong-obovate, 4 cm long, 2–2.5 cm wide, densely sericeous. Seed oblong, plano-convex, 8 mm long, 3.5–4 mm wide.

Specimens examined: BRAZIL. AMAZONAS: Municipality Humayta, near Livramento, rio Livramento, basin of rio Madeira, *Krukoff* 6788 (NY), 7021 (NY, US); Manáos, circa Cachoeira do Mindú, *Ducke* 23473 (US); Manáos, Colonia do Tarumá, *Ducke* 23472 (NY, US); Borba, lower rio Madeira, *Ducke* 23471 (US); Borba, rio Madeira, *Ducke* 75 (NY, US); Manáos, *Ducke* 10 (F); rio Urubú, igárapé Sangana, *Froes* 25448 (NY); Manaus, a margem direita de Reserva Florestal Ducke, *Rodrigues, Coêlho & Coêlho* 8468 (NY); Manáos, 25 m, *Killip & Smith* 30197 (NY, US). PARA: Rio Tapajoz, circa cataractas Mangabal, 31 Aug. 1916 (fl.), 15 Dec. 1919 (fr.), *Ducke* 6803. TERR. RONDONIA: Brasilia-Acre highway, 66 km W of Vilhena, *Maguire, Pires, Maguire & Silva* 56547 (NY). MATO GROSSO: Brasilia-Acre highway, 215 km W of rio Juruena, *Maguire, Pires, Maguire & Silva* 56502 (NY); 20 km E of Vilhena, 670 m, *Maguire, Pires, Maguire & Silva* 56805 (NY, VEN). PERU. LORETO: Mishuyacu, near Iquitos, 100 m, Feb.–Mar. 1930, *Klug* 897 (NY, US).

2. *Sterigmapetalum guianense* Steyermark, *Fieldiana Bot.* 28(2): 422. 1952. TYPE: Venezuela, Estado Bolívar, dense forest at base

of cerro along rio Karuai, Ptari-tepui, 1,220 m, 27 Nov. 1944, *Steyermark* 60658 (F, holotype).—Fig. 1B, C.

Trees 15–20 m tall; branches 3–4-verticillate, terete; upper internodes sericeous, the lower internodes glabrous. Stipules ovate-triangular, obtuse, 6–8 mm long, 2–2.5 mm wide, densely sericeous both sides. Leaves 3–4-verticillate, shortly petiolate, the petioles 5–9 mm long, glabrous to densely sericeous, leaf blades coriaceous, broadly cuneately obovate to obovate- or oval-oblong, subtruncate to slightly emarginate or rounded at the apex, subobtuse to acute at the base, 3.5–8 cm long, 2–7 cm wide, the margins remotely and inconspicuously minutely glandular-denticulate to entire, mainly glabrous except the midnerve beneath sparsely to more densely appressed-pubescent, the lateral nerves 9–12 on each side, arcuate-ascending, anastomosing before the margins, prominently impressed above in subsp. *guianense*, elevated below, the tertiary veinlets conspicuously impressed above in subsp. *guianense*, absent or obsolete in subsp. *ichunense*, conspicuously reticulate below. Inflorescence 1 to 3, terminal or in the axils of the uppermost leaves, compactly dichotomously cymose. *Staminate inflorescence*: peduncles 0.3–3 cm long with two main axes 1.5–2 mm long, moderately to densely appressed-pubescent or pilosulous, 12–15-flowered. Flowers white, on short pedicels 1.5–2 mm long or subsessile, 6–8 mm long, 5 mm wide, 5-merous. Bracteoles narrowly lanceolate, subobtuse, 1.5–2 mm long, 0.5 mm wide, pilosulous both sides, involucrate. Calyx 5-dentate, urceolate, 4–5.5 mm long, 3–3.5 mm wide, glabrous to sparsely pilosulous without, densely sericeous within, the teeth triangular-ovate, subacute, 1.5 mm long. Petals 5, spatulate, dorsally densely pilose, ventrally sparsely pilose, subunguiculate toward the base, 6 mm long at maturity, 1.8 mm wide apically, the central cucullate portion shorter than the lateral flanges, provided with an incurved penicillate tuft; lateral flanges exceeding the central portion, 1.5–2.5 mm long, 3–4-fimbriate, the appendages glabrous. Stamens 10; filaments unequal, 3–4 mm long, united in the basal 1 mm, glabrous; anthers broadly oblong, 1 mm long. Staminodes squamelliform, 1 mm long, bordering the basal sides of the filaments, united with the base of the filaments. Ovary rudiment densely hirsute. *Pistillate inflorescence*: Fruit obovate, 16 mm long, 8 mm broad, densely appressed-pubescent.

KEY TO THE SUBSPECIES OF  
*STERIGMAPETALUM GUIANENSE*

- 1a. Upper leaf surface with prominent and subreticulate tertiary venation .....  
..... 2a. *S. guianense* subsp. *guianense*
- 1b. Upper leaf surface lacking pronounced or subreticulate tertiary venation .....  
..... 2b. *S. guianense* subsp. *ichunense*

**2a. *Sterigmapetalum guianense* Steyererm. subsp. *guianense***

Geographical distribution: Talus slopes and dwarf forest on sandstone table mountains at 1,585–1,615 m altitude in southeastern Estado Bolívar, Venezuela, and dwarf forest bordering savanna at 550–565 m altitude at base of Tafelberg Mountain, Surinam (Fig. 3).

Specimens examined: VENEZUELA, BOLIVAR: Ptari-tepui, *Steyermark 60658* (pistillate plant, type of *S. guianense* subsp. *guianense*, F, holotype); Ptari-tepui, SE slopes bordering quebradas at base of slopes, *Steyermark 60042* (F, US, VEN); vicinity of "Misia Kathy Camp", on mesa between Ptari-tepui and Sororopántepui, 1,615 m, *Steyermark 60288* (F). SURINAM: South Savanna No. I, Tafelberg, 565 m, *Maguire 24737* (F, NY); 200 m, south Savanna No. IV, Tafelberg, 550 m, *Maguire 24780* (NY).

- 2b. *Sterigmapetalum guianense* subsp. *ichunense* Steyermark & Liesner, subsp. nov.**  
TYPE: Venezuela, Bolívar, Sierra Ichún, laderas boscosas y filas al sur del Salto María Espuma (Salto Ichún), a lo largo del río Ichún, tributario del río Paragua, 4°46'N, 63°18'W, 500–625 m, 29 Dec. 1961, *Julian A. Steyermark 90428* (VEN, holotype; NY, US, isotype).—Fig. 2: 1.

A subsp. *guianense* differt nervulis tertiariis foliorum supra haut manifestis vel obsoletis.

Geographical distribution. Sandstone forested areas in southern Venezuela at 110–500 m (Fig. 3).

Additional specimens examined: VENEZUELA, BOLIVAR: Sierra Ichún, *Steyermark 90428* (US, VEN). TERR. FED. AMAZONAS: San Carlos de Río Negro, dense forest alrededores del aeropuerto, 125 m, 17–18 Aug. 1970, *Steyermark & Bunting 102747* (US, VEN); road from San Fernando de Atabapo to Santa Bárbara, 12–40 km from San Fernando, 110 m, 24 Mar. 1974, *Gentry & Tillett 10868* (MO, VEN).

The specimens cited from Terr. Fed. Amazonas tend to have longer petioles and shorter pubescence. Additional collections with flowers from that region may eventually show that an additional subspecies or species is represented.

- 3. *Sterigmapetalum exappendiculatum* Steyermark & Liesner, sp. nov.** TYPE: Venezuela, Bolívar, montane forest, cumbre of La Escalera, Alto río Cuyuni, río Uiri-Yuk, 1,000 m, Aug. 20–21 1962, *Maguire, Steyermark & Maguire 46876* (VEN, holotype; NY, isotype).—Fig. 2: 2.

Arbor 12–20-metralis, ramulis juvenilibus internodiis superioribusque dense pallido-tomentellis; stipulis ovato-lanceolatis subobtusis 7–10 mm longis, 3.5–5 mm latis dense sericeis; foliis 3-verticillatis, petiolis 5–11 mm longis sericeis; laminis subcoriaceis oblongis vel elliptico-oblongis apice rotundatis vel late obtusis raro acutis, basi obtusis vel subacutis 7–14 cm longis 3.7–8 cm latis supra praeter costam sparsim pilosam glabris, subtus modice vel dense adpresso-pilosis costa dense sericea, marginibus utroque latere 11–15 crenulato-denticulatis, nervis lateralibus utroque latere 10–12 adscendentibus ante marginem 4–10 mm anastomosantibus supra conspicue impressis subtus elevatis, venulis tertiariis utrinque manifeste reticulatis elevatisque; inflorescentiis solitariis pedunculatis in axillis foliorum supremorum insidentibus, pedunculis 2–3 cm longis dense breviter puberulis; inflorescentiis foemineis juvenilibus congestis multifloris, bracteis 3–5 mm longis 1–1.5 mm latis; calyce 5-dentato utrinque sericeo; petalis juvenilibus obovato-subdolabriliformibus dorsum superneque papillatis ventraliter inferneque pilosulis, apice breviter pilosulis, parte media apicaliter incurvata tribus appendicibus brevibus instructa, petalorum appendicibus lateralibus nullis; ovario juvenili ovoideo apice obtuse dense hirsutulo 5-lobato basi squamellis circumcincto.

Trees 12–20 m tall; young branches and upper internodes densely tomentellous. Stipules ovate-lanceolate, subobtusely, 7–10 mm long, 3.5–5 mm wide, densely sericeous. Leaves 3-verticillate, the petioles 5–11 mm long, sericeous; leaf blades subcoriaceous, oblong or elliptic-oblong, rounded or broadly obtuse, rarely acute, at the apex obtuse or subacute at the base, 7–14 cm long, 3.7–8 cm wide, glabrous above except sparsely pilose on the midnerve, moderately or densely appressed-pilose below, the midrib densely sericeous, each margin with 11–15 crenulate denticulations, the lateral nerves ascending, 10–12 on each side, anastomosing 4–10 mm from the margin, conspicuously impressed above, elevated below, the tertiary veins manifestly reticulate and elevated both sides. Inflorescence solitary, pedunculate, from the uppermost leaf axils; peduncles 2–3 cm long, densely short puberulous. *Young pistillate inflorescence*: congested, many-flowered, the bracts 3–5 mm long, 1–1.5 mm wide. Calyx 5-dentate, sericeous within and without. Young petals obovate-subdolabriliform, dorsally and above papillate, ventrally and below

pilosulous, the apex shortly pilosulous, the median portion incurved at the apex bearing 3 short appendages, the appendages none. Young ovary ovoid, obtuse at the apex, densely hirsutulous, 5-lobed, surrounded at the base by squamellae.

PARATYPES: VENEZUELA. BOLIVAR: Chimantá Massif, vicinity of Bluff Camp, at base of west-facing sandstone bluffs of Chimantá-tepui (Torono-tepui), 1,700 m, 2–4 June 1954, *Steyermark 75634* (NY, VEN); vicinity of km 143, south of El Dorado, NE of Luepa, 1,200 m, 6–11 Mar. 1962, *Steyermark & Aristeguieta 47* (US, VEN).

Geographic distribution: Montane forests overlying the Roraima sandstone formation, southeastern Estado Bolívar, Venezuela, at 1,000–1,700 meters (Fig. 3).

This species is well-marked by the absence of lateral appendages of the petals, sparse indument of the petals, crenulate-denticulate leaves, and rather densely tomentose stems, peduncles, and lower surface of leaf blades.

4. *Sterigmapetalum colombianum* Monachino, *Trop. Woods* 77: 10. 1944. TYPE: Colombia. Magdalena: Río Jabalí region (La Victoria), 1,000–1,200 m, Dec. 1931–Feb. 1932, *Espina & Giacometto A31* (NY, holotype; F, isotype).

Tree 10–25 m tall; uppermost internodes apparently glabrous but covered by a minute, densely appressed indument. Stipules ovate, subacute, 1.5–2 mm long, 1.2 mm wide, appearing somewhat resinous in bud. Leaves 3–4-verticillate, shortly petiolate, the petioles 2–6 mm long, apparently glabrous but basally with minute hairs; leaf blades subcoriaceous, obovate, rounded at the apex, cuneately acute at the base, 4.5–6.7 cm long, 2–4 cm wide, glabrous on both sides (minute scattered, pale, appressed hairs may be present beneath), entire, the lateral nerves 8–12 on each side, ascending, anastomosing 3–5 mm from the margin; tertiary veins finely reticulate and elevated on both surfaces. *Pistillate inflorescence*: solitary, shortly pedunculate in the axils of the uppermost leaves; peduncles 8–10 mm long, 1–3-flowered, densely minutely appressed-pubescent. Flowers umbellate, sessile (in bud only). Calyx (in bud) apparently 5-dentate, sparsely appressed-pubescent or practically glabrous without, densely appressed-pubescent within. Petals (immature) subobovate, glabrous except ventrally slightly sericeous in the lower half, two lateral flanges each bearing 4–6 glabrous

fimbrillae, the apex of the middle portion between the lateral flanges bearing a tuft of short hairs. Staminodia 10, scalelike and united at the base into an annulus (according to Monachino). Ovary spheroid, pubescent, 5-angulate.

Geographical distribution: Forests of north-eastern Colombia, in Department of Magdalena, at 1,000–1,200 m (Fig. 3).

Two collections, in addition to the type, from the Department of Magdalena, Colombia, both sterile, were identified by Standley as *S. colombianum* and cited by Monachino (1944). The data for these collections are: Cincinnati region, 1,300–1,500 m, Dec. 1931–Feb. 1932, *Espina & Giacometto A142*, and Río Toribio region, slope of San Lorenzo, 1,000–1,200 m, *Espina & Giacometto A90*.

The description of this species is incomplete and unsatisfactory, due to the 1) immature development and fragmentary nature of the inflorescence, and 2) uncertainty of presence or absence of indument on the type collections. Monachino described the species from the NY holotype as having peduncles only “ca. 3 mm long,” but an examination of the F isotype shows peduncles 8–10 mm long. The peduncles and uppermost part of the stems in the NY holotype appear to be covered by a microscopically dense appressed indument, but the F isotype is covered by minute hyphal threads that complicate the interpretation of the presence or absence of indument. Similarly, the calyx tube on the F isotype is covered by fungal hyphae to the extent that uncertainty remains as to whether the exterior surface is completely glabrous or bears some minute appressed indument.

Monachino described the NY holotype as having an inflorescence composed only of the bud of female flowers, “single on end of peduncle” (1944), but the F isotype shows three peduncles arising just below the apical portion of the twigs, each peduncle bearing 3 sessile flowers. In the publication of the Amazonian species of Rhizophoraceae (Albuquerque in Prance et al., 1975), the pedicels of *S. colombianum* are stated to be 3 mm long, whereas this length refers actually to the peduncles of the NY holotype as described by Monachino, since the flower buds themselves are strictly sessile.

The two specimens cited by Albuquerque under *S. colombianum* for Venezuela and Surinam respectively (*Steyermark 90428* and *Maguire 24780*) are treated in the present paper as *S.*

*guianense* subsp. *ichunense* and *S. guianense* subsp. *guianense*. Additionally, a specimen collected by *de la Cruz 2170* from Guyana (NY) and identified as *S. colombianum*, proves to belong to the Malpighiaceae.

**5. *Sterigmapetalum tachirense*** Steyermark & Liesner, sp. nov. TYPE: Venezuela. Tachira: cloud forested ridge top, along steep slopes leading to Cerro Azul, at Cerro Las Minas, 18 km southeast of Santa Ana, 7°36'N, 72°13'W, 1,200–1,380 m, 11 Nov. 1979, tree 20 m tall, leaves coriaceous, spreading, rich green above, pale green below, petals white, calyx pale green, *Julian A. Steyermark, Ronald Liesner & Angel González 120032* (VEN, holotype; MO, isotype).—Fig. 4.

Arbor 20-metralis, ramulis juvenilibus dense minuteque papillato-pubescentibus indumento adpresso munitis; stipulis non visis; foliis 3-verticillatis raro oppositis brevipetiolatis, petiolis 2–2.5 mm longis minute papillato-puberulentibus vel glabrescentibus; laminis suborbiculari-ovalibus apice rotundatis basi rotundatis 6–8.5 cm longis 5.3–7 cm latis utrinque glabris integerrimis; nervis lateralibus utroque latere 12–13 divaricate patentibus ante marginem 2–7 mm anastomosantibus; inflorescentiis masculinis solitariis in axillis foliorum supremorum pedunculatis; pedunculis 1.2–1.7 cm longis sparsim vel modice minuteque adpresso-puberulentibus pilis papillatis instructis, cymoso-ramosis, axibus secundariis 4–5 mm longis minute adpresso-puberulentibus flores crebros gerentibus; floribus masculinis breviter pedicellatis, pedicellis 0.5 mm longis; calyce profunde campanulato 3.5–4 mm longo 2–2.8 mm lato, tubo 2.5 mm longo extus sparsim adpresso-puberulenti glabrescenti intus sparsim adpresso-piloso; calycis lobis 4 deltoideo-ovatis obtusis 1.2–1.5 mm longis 1.3 mm latis extus praeter apicem ciliolatum glabris intus dense adpresso-pubescentibus; petalis 4 anguste oblanceolato-ligulatis 5 mm longis basi 0.5 mm latis, superne 1.5 mm latis basim versus unguiculatis, ungue 1.5 mm lato; petalis apice 3-lobatis, parte centrali cucullata segmentis aggregatis incurvatis munita, utroque latere extensionibus duobus lateralibus in 15–18 fimbriis elongatas glabras fissis, infra segmentos laterales marginesque dense hispidulis; staminibus 8, filamentis 3.5 mm longis 0.2 mm latis basi 0.5 mm longis connatis; antheris anguste oblongis 1.2–1.5 mm longis 0.4 mm latis; staminodiis subulatis apice paullo angustatis 1 mm longis; ovarii rudimento conico 1 mm longo basi 0.7 mm lato adpresso-piloso.

Trees 20 m tall; juvenile branches covered with dense, minute, appressed papillate indumentum. Stipules not seen. Leaves 3-verticillate, rarely opposite, short-petioled, the petioles 2–2.5 mm long, minutely papillate-puberulent or glabrescent; leaf blades suborbicular-oval, rounded at the apex, rounded at the base, 6–8.5 cm long, 5.3–7 cm wide, entire, both sides glabrous, the lateral nerves

12–13 each side, divaricately spreading, anastomosating 2–7 mm from margin. *Staminate inflorescence*: solitary in axils of the uppermost leaves; cymosely branched, the secondary axes 4–5 mm long, minutely appressed-puberulent; peduncles 1.2–1.7 cm long, sparsely or moderately appressed-puberulent, the hairs papillate; flowers in close succession. Flowers with pedicels 0.5 mm long. Calyx deeply campanulate, 3.5–4 mm long, 2–2.8 mm wide, the tube 2.5 mm long, sparsely appressed-puberulent, glabrescent without, sparsely appressed-pilose within. Calyx lobes 4, deltoid-ovate, obtuse, 1.2–1.5 mm long, 1.3 mm wide, glabrous without except for the ciliate apex, within densely appressed-pubescent. Petals 4, narrowly oblanceolate-ligulate, 5 mm long, 0.5 mm wide at the base, upwards 1.5 mm wide, unguiculate toward the base, the claw 1.5 mm wide; petal apices 3-lobed, the central part cucullate, provided with incurved, clustered segments, on each side with two lateral flanges parted into 15–18 elongate, glabrous fimbria, the lateral segments below and the margins densely hispid-pubescent. Stamens 8; filaments 3.5 mm long, 0.2 mm wide at the base, connate in the basal 0.5 mm; anthers narrowly oblong, 1.2–1.5 mm long, 0.4 mm wide; staminodes subulate, somewhat narrowed at the apex, 1 mm long. Ovary rudiment conical, 1 mm long, 0.7 mm wide at the base, appressed-pilose.

Geographical distribution: Montane forests of Estado Táchira, western Venezuela, at 1,200–1,380 m elevation (Fig. 3).

This species differs from the other known members of the genus in its tetramerous flowers with 4 calyx lobes, 4 petals, and 8 stamens, and in the suborbicular-oval leaves rounded at both ends.

***Sterigmapetalum* subgenus *Balsamocaulon*** Steyermark & Liesner, subgenus novum. TYPE: *Sterigmapetalum resinum* Steyermark & Liesner.

Exsudatum resinum adest. Folia opposita. Extensiones laterales petalorum deminutae vel obsoletae.

**6. *Sterigmapetalum resinum*** Steyermark & Liesner, sp. nov. TYPE: Venezuela. Bolívar: selva húmeda en las laderas del Cerro Uei, entre los brazos del río Uei (afluente del río Venamo y Cuyuni), km 121.5 south of El Dorado, 1,050 m, 27–28 Dec. 1970, tree 20 m, leaves coriaceous, deep green above, dull

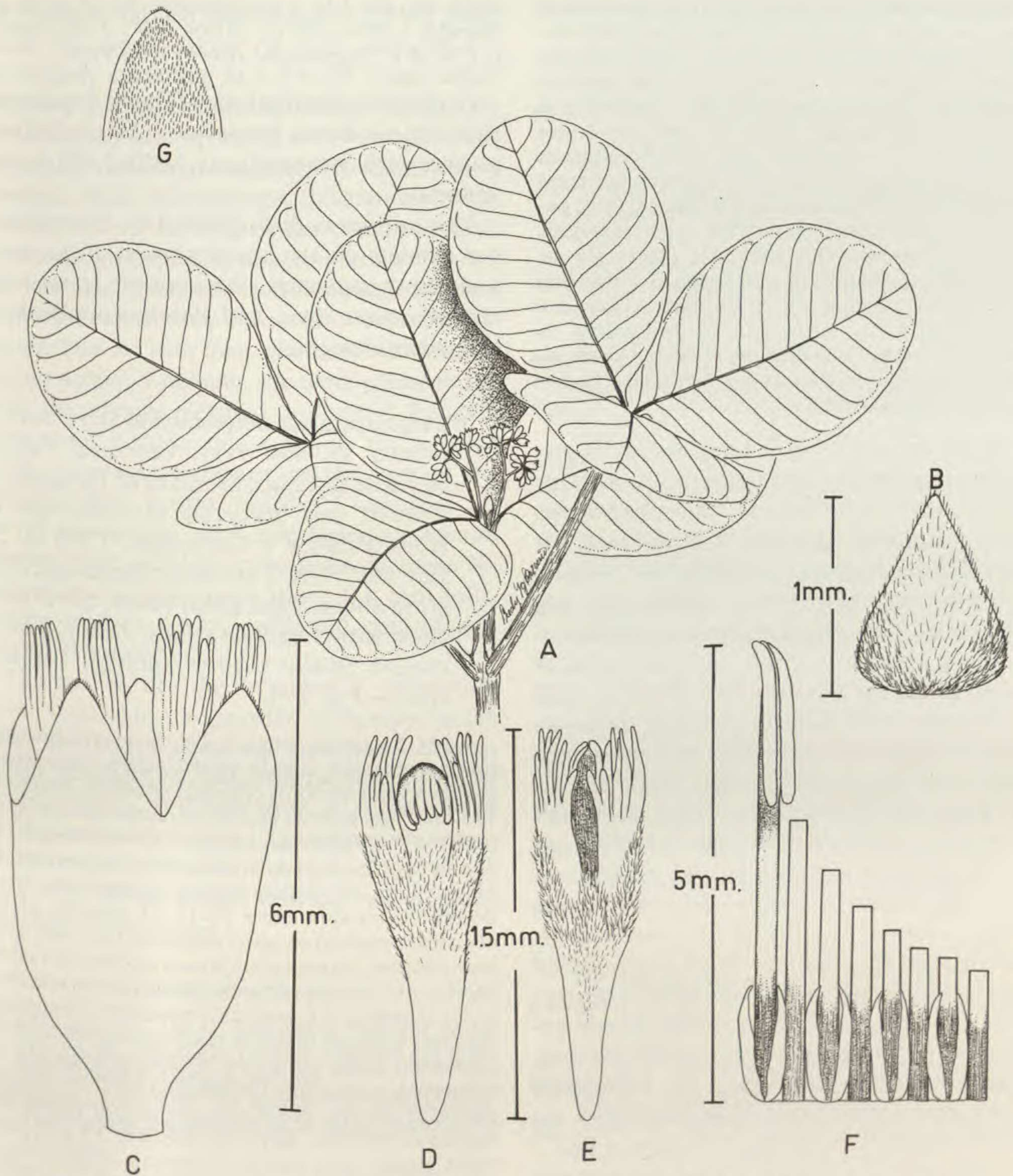


FIGURE 4. *Sterigmapetalum tachirense*. A. Habit, flowering branch,  $\times 1$ . B. Ovary rudiment, staminate flower. C. Staminate flower, lateral view. D. Petal, ventral view, staminate flower. E. Petal, dorsal view, staminate flower. F. Androecium, staminate flower, showing one complete stamen, the other stamens with portions of filaments attached to basal membrane. G. Inner upper surface of calyx lobe.

green below, Julian A. Steyermark, G.C.K. & E. Dunsterville 104569 (US, holotype, sheet No. 2581558-A; US, isotype, sheet 2581559-A).—Fig. 2: 3.

Arbor 20–25-metralis, ramulis glabris vel glabrescentibus, internodiis supremis resinosis; stipulis supremis subresinosis lanceolato-ovatis acutis vel acuminatis 4–5 mm longis glabris demum caducis; foliis oppositis petiolatis, petiolis 10–15 mm longis glabris

vel glabrescentibus, laminis coriaceis oblongo-ellipticis vel oblanceolato-oblongis apice abrupte angustatis acutis vel obtuse acutis basi acutis 5–10.5 cm longis 2–5 cm latis utrinque glabris subtus obsolete minuteque glanduloso-punctatis, marginibus utroque latere 15–16-subcrenulatis in sinibus glanduliferis; nervis lateralibus utroque latere 11–14 ad angulum 20–25° patentibus supra impressis subtus paullo elevatis ante marginem 2–4 mm anastomosantibus, venulis tertiariis subtus aliquantum manifestis subreticulatisque supra vix manifestis; inflorescentiis masculinis (imma-

turis) resinosi solitarii in axillis nodorum supremorum secundorum usque ad sextos breviter pedunculatis insidentibus, pedunculis (immaturis) 1–1.7 cm longis minute parceque puberulis ca. 6-floris; floribus breviter pedicellatis in cymis ramosis dispositis, pedicellis in alabastro 0.5 mm longis; calyce in alabastro 2 mm longo subcoriaceo 5-angulato, lobis 5 deltoideo-ovatis subacutis marginibus elevatis apice pilosis extus aliter glabris intus superne minute pilosulis aliter glabris; petalis 5 (immaturis) panduriformibus apice rotundatis cucullatis, appendices tres subulatas incurvatas gerentibus basi rotundatis 0.8 mm longis 0.3 mm latis utrinque glabris dorsum obtuse carinatis, extensionibus lateralibus nullis; staminibus 10 (immaturis), filamentis brevissimis basi dilatatis connatis; ovarii rudimento ovoideo-conico apice rotundato glabro 5-angulato; stigmate sessili.

Trees 20–25 m tall; branches glabrous or glabrescent; uppermost internodes resinous. Uppermost stipules subresinous, lanceolate-ovate, acute or acuminate, glabrous, 4–5 mm long, caducous. Leaves opposite, petiolate, the petioles 10–15 mm long, glabrous or glabrescent; leaf blades coriaceous, oblong-elliptic or oblanceolate-oblong, the apex abruptly narrowly acute or obtusely acute, the base acute, 5–10.5 cm long, 2–5 cm wide, both surfaces glabrous, abaxially obsoletely minutely glandular punctate, each margin with 15–16 subcrenulate teeth, the sinuses glandular, the lateral nerves on both sides 11–14, spreading at a 20–25° angle, adaxially impressed, abaxially slightly elevated, anastomosing 2–4 mm from the margin, the tertiary veins abaxially more or less manifestly subreticulate, adaxially scarcely manifest. *Male inflorescence*: (immature) resinous, solitary, in axils of the second to the sixth uppermost nodes shortly pedunculate; peduncles (immature) 1–1.7 cm long, minutely sparsely puberulous ca. 6-flowered; flowers short-pedicellate in branched cymes, the pedicels in bud 0.5 mm long. Calyces in bud 2 mm long, subcoriaceous, 5-angled, 5-lobed, the lobes deltoid-ovate, subacute, margins elevated, abaxially pilose at the apex, otherwise glabrous, minutely pilose within, otherwise glabrous. Petals 5, (immature), panduriform, rounded, cucullate at the apex, the appendages three, subulate, incurved, the base rounded, 0.8 mm long, 0.3 mm wide, both sides glabrous, dorsally obtusely keeled, the lateral appendages absent. Stamens 10 (immature); filaments very short, dilated and connate at the base. Ovary rudiment ovoid-conical, the apex rounded, glabrous, 5-angled; stigma sessile.

PARATYPE: VENEZUELA. BOLÍVAR: En el drenaje del río Cuyuni, a lo largo del río Anawaray-parú, vecin-

dades del km 134 y campamento 134 al sur de El Dorado, 1,300–1,350 m, 25 Dec. 1970, *J. Steyermark, G.C.K. & E. Dunsterville 104463* (US, VEN).

Geographic distribution: Montane forests over Roraima sandstone formation of Estado Bolívar, southeastern Venezuela, at 1,050–1,300 m elevations.

This species is distinguished by the resiniferous exudate on the apical portion of the stem, buds, and peduncles, the opposite leaves with abruptly acute apex, and glabrous petals which lack lateral flanges.

#### 7. *Sterigmapetalum heterodoxum* Steyermark &

Liesner, sp. nov. TYPE: Venezuela. Falcón: Sierra de San Luis, Montaña de Paraguariba, forested area bordering savanna, entre el Hotel Parador y Curimagua, 1,300 m, 21 July 1967, tree 3 m, leaves coriaceous, deep green above, paler green below, flower buds green with 5 valvate sepals, *Julian A. Steyermark 99409* (VEN, holotype; US, isotype).—Fig. 2: 4.

Arbor 3-metralis, ramulis glabris, internodiis superioribus resinosi; stipulis suborbiculari-ovatis obtusis glabris resiniferis; foliis oppositis petiolatis, petiolis 8–11 mm longis glabris, laminis coriaceis obovatis apice truncato-rotundatis basi cuneatis 5.5–9 cm longis 3.5–5 cm latis utrinque glabris, marginibus inconspicue 11–12-crenulatis in sinibus minute glanduliferis, nervis lateralibus utroque latere 10–11 ad angulum 15–20° divaricate patentibus ante marginem 2–5 mm anastomosantibus, supra subimpressis inconspicuis subtus subelevatis, venulis tertiariis subtus minute reticulatis supra obsoletis; inflorescentiis masculinis (immaturis) resinosi solitarii in axillis nodorum supremorum secundorum usque ad sextos breviter pedunculatis insidentibus, pedunculis (immaturis) 1.2–1.5 cm longis glabris ca. 5-floris; floribus (immaturis) ut videtur subsessilibus resinosi; calyce in alabastro 3.5 mm longo extus glabro intus sericeo 5-dentato, dentibus apice pilosulis marginibus elevatis induratis; petalis 5 (immaturis) dorso superne pilosis, marginibus ciliatis aliter glabris, apice parte centrali cucullata hispida, appendices tres subulatas incurvatas gerentibus, utroque latere extensionibus duobus lateralibus inaequalibus erectis appendices duas subulatas gerentibus; staminibus 10 inaequalibus in alabastro, filamentis brevissimis 0.6 mm longis basi connatis; ovarii rudimento columnari-subconico 0.6 mm longo.

Trees 3 m tall; branches glabrous; upper internodes resinous. Stipules suborbicular-ovate, obtuse, glabrous, resinous. Leaves opposite, the petioles 8–11 mm long, glabrous; leaf blades coriaceous, obovate, the apex truncate-rounded, the base cuneate, 5.5–9 cm long, 3.5–5 cm wide, both sides glabrous, the margins inconspicuously 11–

12 crenulate-toothed, the sinuses minutely glandular, the lateral nerves on both sides 10–11, divaricately spreading at a 15–20° angle, anastomosing 2–5 mm from the margin, above inconspicuously subimpressed, below subelevated, the tertiary veins below minutely reticulate, above obsolete. *Male inflorescence*: (immature) resinous, solitary, in the axils of the second to sixth uppermost nodes; peduncles (immature) 1.2–1.5 cm long, glabrous, about 5-flowered. Flowers (immature) apparently sessile, resinous. Calyxes in bud 3.5 mm long, glabrous without, sericeous within, 5-dentate, the teeth pilose at the apex, the margins elevated, indurated. Petals 5 (immature); dorsally pilose above, the margins ciliate, otherwise glabrous; central part of the apex cucullate, hispid, bearing 3 subulate, incurved appendages, each side bearing 2 lateral, unequal, erect, subulate appendages. Stamens 10, unequal in bud; filaments short, 0.6 mm long, basally connate. Ovary rudiment conical-subconical, 0.6 mm long.

This species, like the foregoing *S. resinosum*, is well-marked by the resiniferous exudate on the upper internodes, buds, and peduncles, characteristic of subgenus *Balsamocaulon*, and by the opposite leaves. It differs from *S. resinosum* in having the leaves truncate-rounded at the apex, stipules obtuse, and petals densely pilose at the apex with lateral flanges bearing two unequal fimbriate appendages.

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